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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MITSUBISHI DENKI KABUSHIKI KAISHA

Appeal 2007-2483
Application 09/899,183
Technology Center 1700

Decided: September 12, 2007

Before RICHARD E. SCHAFER, RICHARD TORCZON, and SALLY C.
MEDLEY, *Administrative Patent Judges*.

TORCZON, *Administrative Patent Judge*.

DECISION ON APPEAL

The subject matter of the claims on appeal relates to a vaporizing device used for chemical vapor deposition (CVD) materials or an apparatus employing such a device.¹ All of the pending claims have been rejected as unpatentable under 35 U.S.C. 103. The appellant (Mitsubishi) seeks review of the rejections. We affirm.

¹ Specification (Spec.) 1:2-6.

THE CLAIMS

Representative claim

Claims 15-18 are pending. Mitsubishi does not provide separate arguments for the claims, instead providing arguments for both independent claims together and no separate argument for the two dependent claims.² Following the Board rule governing appeal briefs, we select claim 15 as representative of the claims on appeal. The remaining claims stand or fall with the rejection of claim 15.³

Claim 15 defines the subject matter of the invention as follows:⁴

15. A vaporizing device for vaporizing chemical vapor deposition (CVD) source materials comprising:

a vaporizer for vaporizing CVD source materials by heating, the vaporizer including a chamber having a heat conductive chamber wall with an inlet for introducing the CVD source materials into the chamber;

a spray nozzle having a first end located to spray a CVD source material into the chamber through the inlet;

a plate having at least one portion thinner than the chamber wall, contacting and locating the spray nozzle relative to the inlet to spray CVD source materials into the chamber, the plate limiting thermal conduction from the chamber wall, thereby thermally insulating the spray nozzle from the chamber wall;

a cooling block in physical contact with a portion of the spray nozzle adjacent the plate and surrounding the spray nozzle for conducting heat from and cooling the spray nozzle; and

a heat conduction restricting region between the cooling block and the chamber wall, thermally isolating the spray nozzle and the cooling block from the chamber wall.

² Appellant's Appeal Brief (Br.) 3-7.

³ 37 C.F.R. § 41.37(c)(1)(vii).

⁴ From Mitsubishi's claim appendix, Br. 8.

Claim construction

The Board must construe pending a claim as broadly as its terms reasonably allow.⁵ The applicant, as drafter of the claim, has the obligation to ensure that the claim has the intended scope, particularly when facing an alternate construction from the examiner.⁶ We focus on contested limitations.⁷

nozzle

The examiner construes "nozzle" to include housing and mounting structures associated with the spraying end.⁸ Mitsubishi describes this construction as "unreasonable",⁹ but provides no specific definition of its own. In particular, Mitsubishi has not pointed to intrinsic evidence or provided extrinsic evidence that would require a construction of "nozzle" limited to the conical end of the nozzle assembly. From claim 15 itself, we know the nozzle is "a spray nozzle having a first end located to spray a CVD source material into the chamber through the inlet". The claim further

⁵ *In re Zletz*, 893 F.2d 319, 321, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989) (rejecting a narrow construction); *In re Etter*, 756 F.2d 852, 858-59, 225 USPQ 1, 5-6 (Fed. Cir. 1985) (en banc).

⁶ *In re Morris*, 127 F.3d 1048, 1056, 44 USPQ2d 1023, 1029 (Fed. Cir. 1997); *In re Queener*, 796 F.2d 461, 464, 230 USPQ 438, 440 (Fed. Cir. 1986) (Newman, AJ, concurring).

⁷ *Aero Prods. Int'l, Inc. v. Intex Recreation Corp.*, 466 F.3d 1000, 1012 n.6, 80 USPQ2d 1481, 1488 n.6 (Fed. Cir. 2006) (appropriate to focus construction on disputed limitations), citing *Scripps Clinic & Research Found v. Genentech, Inc.*, 927 F.2d 1565, 1580, 18 USPQ2d 1001, 1013 (Fed. Cir. 1991).

⁸ Examiner's Answer (Ans.) 3 and 5.

⁹ Br. 4.

defines the nozzle in terms of other structures that are near and thermally insulate the nozzle, but not in terms of what structures constitute the nozzle itself. As explained below, however, we need not resolve this contest since claim 15 would have been obvious even with Mitsubishi's construction.

adjacent

The examiner and Mitsubishi cite a general dictionary definition in support of competing constructions of the word "adjacent". Neither, however, provides a copy of the definition or lists it as evidence on appeal so we accord no weight to the absent dictionary definition. In any case, general dictionary definitions are entitled to less weight than definitions or usage in the specification or in the art.¹⁰ Mitsubishi has not pointed us to any place in the disclosure where the word "adjacent" appears. Indeed, the best evidence in the record actually before us on appeal appears in two cited references: the Li¹¹ and Zhao¹² patents.

Li uses "adjacent" and "immediately adjacent" to describe the proximity of a curtain gas inlet port **28** and a thermocouple **32**, respectively, to a cooling jacket **26**, all shown in FIG. 2 (reproduced below).¹³ The structures in both cases are fairly near but not touching the cooling jacket. Li also discloses an evaporator unit **58** that is bolted to "adjacent units" in

¹⁰ *Multiform Desiccants, Inc. v. Medzam, Ltd.*, 133 F.3d 1473, 1478, 45 USPQ2d 1429, 1433 (Fed. Cir. 1998).

¹¹ Ting Kai Li & Dane C. Scott, *Liquid vaporizer system and method*, US 5,835,678 (issued 10 November 1998) (Li). The Examiner's Answer (Ans.) has a typographical error in the Li patent number on page 3 in the evidence list.

¹² Jun Zhao et al., *Chemical vapor deposition vaporizer*, US 6,210,485 B1 (issued 3 April 2001) (Zhao).

¹³ Li 10:20-29.

FIG. 4, but neither the figure nor the text illustrate with any precision what "adjacent" means in this context.¹⁴

Zhao describes a vaporizing module **16** as "mounted adjacent" to a chamber body **12**, citing FIGS. 1 and 2.¹⁵ It is not clear from the figures whether the two structures touch although they are plainly close to each other. Zhao also describes a cooling channel as adjacent to an O-ring seal, but the channel is not shown or more particularly described, which makes its proximity difficult to determine.¹⁶ Finally, Zhao describes a gas conduit **202** as "partially adjacent" to a heating jacket **220** in FIG. 5.¹⁷ Again, the figure is ambiguous since the structures are relatively close, but it is not clear whether an unlabeled spur touching the gas conduit **202** is part of the heating jacket **220**.

Neither patent uses "adjacent" as a specialized technical term. Li uses "adjacent" to connote a close but not necessarily touching relationship. Zhao's usage is consistent with either touching or not touching, but generally in close proximity. Both use further modifiers like "immediately" and "partially", which suggests that a range of proximate positions are possible. In view of our obligation to construe claims as broadly as is reasonable in view of the specification and the understanding in the art, we conclude that "adjacent" means "near to", but not necessarily touching.

¹⁴ Li 13:30-34.

¹⁵ Zhao 4:16-20.

¹⁶ Zhao 5:41-43. As a practical matter it seems unlikely that Zhao would want the O-ring to be subjected directly to cooling fluids.

¹⁷ Zhao 8:52-55.

THE REJECTIONS

The examiner contends that the claims would have been obvious to a person having ordinary skill in the art in view of these patents. The examiner bases the rejection of claims 15 and 17 on the Li and Zhao patents.¹⁸ The rejection of the other two claims also involves a third reference, which is moot since these claims stand or fall with claim 15.

In analyzing obviousness, the scope and content of the prior art must be determined, the differences between the prior art and the claims ascertained, and the ordinary level of skill in the art resolved. Objective evidence of the circumstances surrounding the origin of the claimed subject matter (so-called secondary considerations) may also be relevant. Such secondary considerations guard against the employment of impermissible hindsight.¹⁹ Mitsubishi has not directed us to any evidence of secondary considerations.²⁰

Scope and content of the prior art

The Li patent

Li's disclosure relates to a CVD apparatus, and particularly a precursor liquid vaporization device with improved rate and stoichiometry

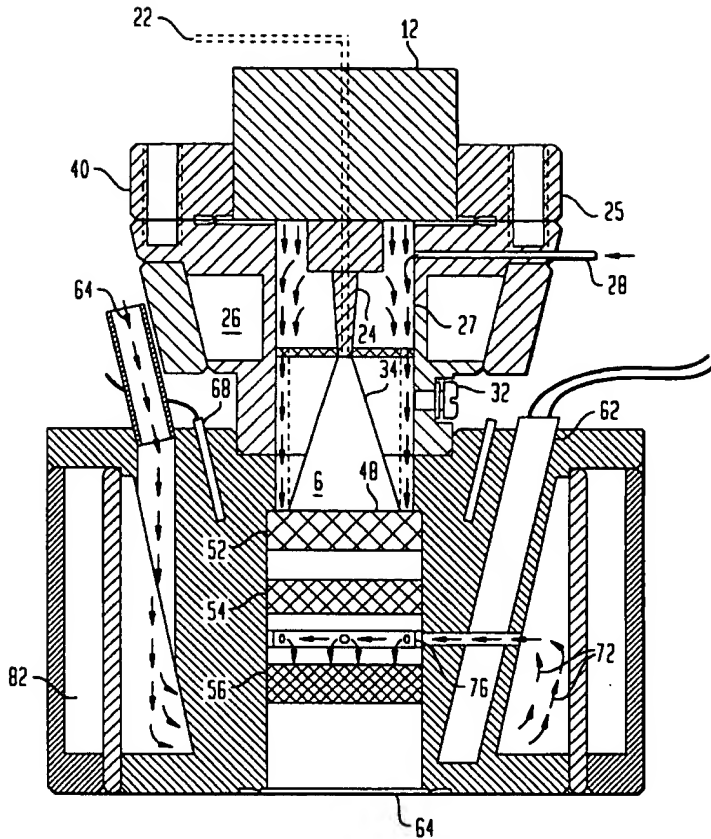
¹⁸ Final Rejection 2.

¹⁹ *Graham v. John Deere Co.*, 383 U.S. 1, 17, 36 (1966), *cited with approval in KSR Int'l v. Teleflex Inc.*, 127 S. Ct. 1727, 82 USPQ2d 1385 (2007). The record on appeal does not contain objective evidence of secondary considerations.

²⁰ Br. 10.

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 control.²¹ Li's FIG. 2 (right,

color added) shows a vaporizer. Li's vaporizer has a feed tube **22** that brings the CVD source materials to the vaporizer. The feed tube **22** leads to an ultrasonic nozzle **24**, which sprays the source material into a chamber **6**. A cooling jacket **26** surrounds the nozzle **24**. A curtain gas inlet **28** adjacent to the cooling jacket **26** feeds in curtain gases **27** along the walls of the chamber.²²



The unnumbered plate (in red) appears to define an inlet into the chamber **6** and to position the nozzle **24** such that it sprays through the inlet and into the chamber **6**. The unnumbered neck (green) connecting the cooled upper delivery component from the heated lower expansion component is narrow and provides a degree of separation between the two components.

²¹ Li 1:11-15.

²² Li 10:13-26. Li's text at this point actually labels the cooling gas "**25**", which cannot be correct. When discussing a later embodiment (12:47-50), Li uses "**27**" and "**27**'" to indicate the curtain gases and "**25**" and "**25**'" to label nozzle mounting segments, which makes more sense.

The Zhao patent

The Zhao patent relates to an apparatus and process for vaporization of liquid precursors in a CVD system.²³ The embodiments shown in FIG. 4 (right, color added) and FIG. 5 (below, left, color added) show a neck **142** (green) between the upstream components and the downstream components. The neck **142** is narrower than the

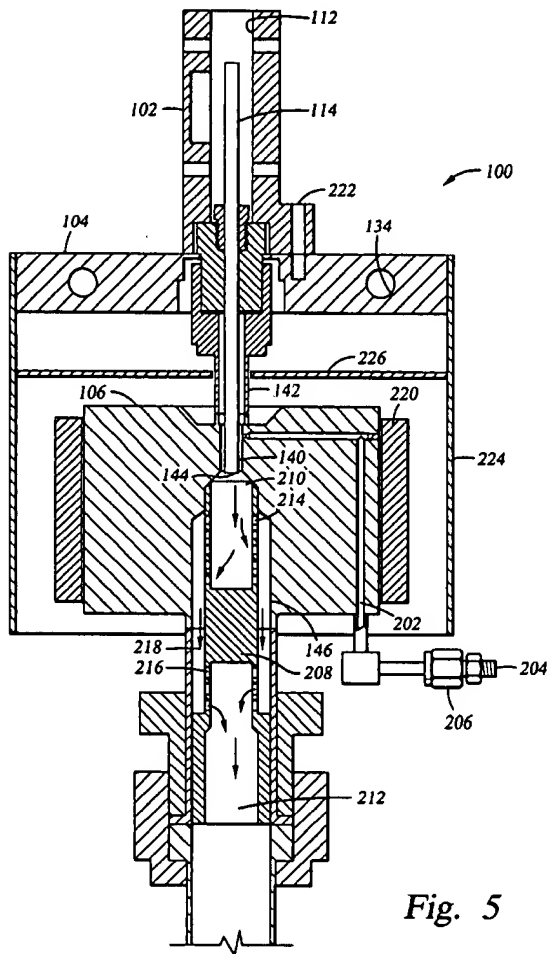


Fig. 5

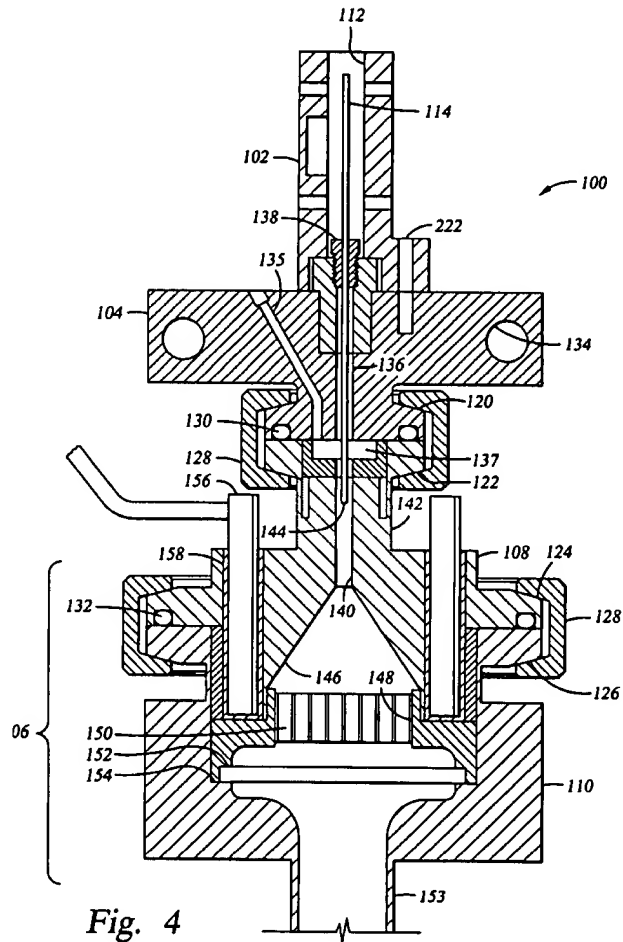


Fig. 4

walls of the expansion chamber and thermally isolates the upper and lower components. Zhao explains that since the upper components are cooled and the lower components are heated, the neck **142** prevents heat loss and the

²³ Zhao 1:13-15 and 3:65-66.

development of cold spots.²⁴ Zhao notes that the especially thin neck of the second embodiment provides additional thermal insulation. Zhao also recommends using materials with relatively low thermal conductivity to enhance the insulating effectiveness of the neck, particularly stainless steel and PTFE.²⁵

Differences between the prior art and the claims

Mitsubishi contends that Li does not teach a cooling block in physical contact with a portion of the spray nozzle adjacent to the plate.²⁶ This contention is true if the narrow definitions that Mitsubishi urges for "nozzle" and "adjacent" are correct.

Mitsubishi also contends that Li has no heat conduction restriction region.²⁷ The examiner appears to concede²⁸ that—

Fig. 2 of Li illustrates a middle portion (where thermocouple 32 is located) that is positioned between and connects the lower heated portion of Li's vaporizer with the cooled upper portion of the vaporizer. Li does not disclose the middle portion as designed or intended to act as a heat conduction restricting region, and in view of the schematic nature of patent drawings it is not clear from Li's Fig. 2 that the middle portion is a heat conduction restricting region.

We are not convinced that Li does not teach a heat conduction restriction region. A reference must be evaluated from the perspective of

²⁴ Zhao 7:34-43 and 9:29-35.

²⁵ Zhao 9:29-35. We note that PTFE is polytetrafluoroethylene, a heat-resistant plastic. Cf. Spec. 12:11-14, recommending the heat conduction restricting means be formed of, inter alia, stainless steel or heat-resistant plastic.

²⁶ Br. 4.

²⁷ Br. 4-5.

²⁸ Ans. 4.

those skilled in the art and thus need not spell out what would already be apparent to them.²⁹ Li's "middle" region is strikingly similar to Zhao's neck. It is markedly narrower than the walls of the expansion chamber and spaces the upper and lower components apart. Even assuming that Li happened upon this configuration out of sheer serendipity, after the Zhao patent issued the significance of the narrowed middle would have been clear to those in the art.

The ordinary level of skill

We look to the evidence of record—the applicant's disclosure, the cited references, and any declaration testimony—in resolving the ordinary level of skill in the art. We focus on what those of skill in the art know and can do.³⁰

The specification offers little explicit guidance on what those in the art knew and could do beyond following the teachings in the specification. In particular, the background art cited is less relevant to the subject matter claimed than the references the examiner cited. The art does appear to have recognized that control of the temperature of the precursors before they are sprayed is critical to success.³¹

Mitsubishi discloses a metal block **18** in contact with both a cooling liquid flow path **20** and a nozzle **7**.³² In describing this arrangement, Mitsubishi provides little detail and no explanation of why it is necessary or

²⁹ *In re Paulsen*, 30 F.3d 1475, 1480-81, 31 USPQ2d 1671, 1675 (Fed. Cir. 1994).

³⁰ *Ex parte Jud*, 2006 WL 4080053 at *2 (BPAI) (rehearing with expanded panel).

³¹ Spec. 4:13-27.

³² Spec. 9:19-10:4.

what difficulties were overcome or what practical trade-offs were made.

Presuming as we must that the specification is enabling,³³ we infer that those of skill in the art have a solid understanding of the thermodynamics, material science, and mechanical engineering necessary to understand and implement the teachings of the specification.

Li confirms that temperature control for the precursor materials was a well-understood consideration, not just in spray-nozzle systems, but generally.³⁴ Indeed, Li places a thermocouple **32** in the neck between the heated component and the plate to determine the temperature of the precursor spray immediately after it leaves the nozzle **24** and thus control the temperature of the cooling jacket **26** surrounding the nozzle **24**.³⁵ From Li, we infer that those in the art were keenly concerned with the temperature of the precursors up to the very tip of the nozzle. Li's use of a thermocouple to measure the spray temperature as part of a feedback-based control shows that the skill in the art was quite advanced.

Similarly, Zhao confirms that those in the art were keenly aware of the need to keep the delivery components cool and thermally separate from the heated main body **106**. Again, Zhao shows an art quite advanced and able to select appropriate materials and structures to accomplish this goal.³⁶ Zhao states without detail that "several active and passive thermal control systems" are used to maintain the temperature of the vaporizer component,

³³ *E.g., Rasmusson v. SmithKline Beecham Corp.*, 413 F.3d 1318, 1323, 75 USPQ2d 1297, 1300 (Fed. Cir. 2005).

³⁴ Li 2:29-31; see also Li 3:34-36 (citing selectable temperature control for the precursors as an object of Li's invention).

³⁵ Li 10:26-33.

³⁶ *E.g., Zhao* 9:21-35.

which evinces confidence that those in the art would understand and be able to use such systems without elaboration.³⁷

Taken as a whole, the evidence on appeal shows an art keenly aware of the need to keep the spray cool and to keep the cool delivery components and the heated expansion components thermally separated. The art shows considerable variety and sophistication in the approaches taken to accomplish these goals. These include control systems to regulate the temperature of precursor materials until they leave the nozzle tip and devices to insulate the heated and cooled components from each other.

ANALYSIS

While the examiner has focused on the breadth of the claim to justify the rejection, thus setting up a claim-construction dispute particularly over the meaning of "nozzle", the cited references provide ample evidence in support of obviousness even under a narrower construction of "nozzle". Obviousness is not a multi-reference anticipation: there is no need for the limitations to exist as claimed in the art simply awaiting combination. One can look to the skill in the art to provide reasons to modify as well.

Even when a claim contains considerable structural detail, its subject matter may still have been obvious to those skilled in the art.³⁸ Even under Mitsubishi's narrower construction of "nozzle", Li (understood in light of Zhao) shows all of the limitations of claim 15 except the cooling block in physical contact with the portion of the nozzle adjacent to the plate. Since Li's nozzle touches the plate, any part of the nozzle (narrowly construed as

³⁷ Zhao 5:1-12.

³⁸ *In re Gorman*, 933 F.2d 982, 987, 18 USPQ2d 1885, 1889 (Fed. Cir. 1991) (affirming the rejection of a so-called "picture claim").

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Mitsubishi wishes) is adjacent to the plate as "adjacent" is used in the art. Thus, the missing modification is the physical contact between Li's cooling jacket and some part of the nozzle.

Why modify Li to permit physical contact between the nozzle (the contents of which must remain cool) and the cooling jacket? The question begs the answer. The efficiency of the cooling jacket could only be enhanced by physical contact, which would permit among other things cooling by conduction. Might there be trade-offs? Even the unskilled would appreciate that physical contact to the extent that it interferes significantly with Li's curtain gases should be avoided. If there are other problems arising from direct contact, Mitsubishi's specification provides no guidance about them. Thus, any problems or trade-offs that may exist are within the skill of the art to recognize and resolve.

CONCLUSION

The subject matter of claim 15 would have been obvious to a person having ordinary skill in the art in view of the Li and Zhao patents. The other claims stand or fall with claim 15. Consequently, the rejection of claims 15-18 is—

AFFIRMED

VW

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